



Outlook for Natural Gas Supply: *Myths and Realities*

Presented by:

Vello A. Kuuskraa

Advanced Resources International, Inc.

703-528-8420, vkuuskraa@adv-res.com

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Natural Gas Is In Short Supply

"The wolf is always at the door."

Eagles

"Pessimists see a serious natural gas crunch on its way. . . . diminishing production and an increasingly volatile market make supplies dangerously tight or prices punishingly high – or both."

USA Today

"... the crunch could show up sooner. . . We're going to pay a painful price . . . by the third or fourth quarter."

**Matthew Simmons
Chairman, Simmons & Co.**

Supplies Will Be Adequate and Moderately Priced

**"High Levels of Gas Reserve Additions
are Projected Through 2020"**

DOE/EIA Annual Energy Outlook 2002

Moneyline
Thursday markets

Energy scandal crisis

Crisis looms as demand booms for natural gas

More casual restaurants try

Cover story

Crisis looms as demand booms for natural gas

Grey Wolf Drilling

Well, well: A crew used the largest land-drilling rig in the USA to drill the Bighorn 8-35 in Wyoming. A typical gas well goes about 11,000 feet deep. Bighorn went to 25,018 feet and will cost about \$35 million.

Production falls as it gets hard to get popular fuel

By George Hager
USA TODAY

LYSITE, Wyo. — What looks odd in this tiny town in the middle of Wyoming's vast Wind River Basin is all the windsocks. There's no operating airport here, so why all the fluorescent orange wind-direction indicators?

It turns out that Burlington Resources wants you to know where upwind is at any given moment, because that's where you need to go — and fast — if there's a hydrogen sulfide leak from any of the six ultradeep natural gas wells Burlington and others have drilled near here into the nearly 5-mile-deep bedrock that holds one of the most prolific gas fields in the USA.

Along with prodigious quantities of natural gas, what boils up out of the wells' specially made, high-alloy tubing is 126,000 parts per million of hydrogen sulfide, which can quickly kill you in concentrations of as little as 500-1,000 parts per million. Each visitor gets a mandatory safety lecture and a portable tank of emergency air.

With U.S. production in inexorable decline, producers are increasingly turning to exotic wells like this one to try to keep up with Americans' burgeoning demand for natural gas. Gas burns much

Natural gas price peak
Weekly natural gas prices (dollars per million British thermal units):

Date	Price (\$/MMBtu)
Dec. 21, 2000	\$10.48
Jan. 8, 2001	\$10.35
May 29, 2002	\$3.30

Source: EIA's Natural Gas Week
By Marcy E. Mullins, USA TODAY

more cleanly than coal and, after any hydrogen sulfide has been stripped out of deep-well gas and turned into sulfur, it carries few of the safety worries that come with nuclear power.

That makes it a premium, environmentally benign and increasingly popular fuel for homes, factories and electric utilities. Most new electrical generating plants are designed to burn gas, and 55% of American homes use it for heating or cooking, according to the American Gas Association.

But while public worry tends to focus on sup-

Please see COVER STORY next page ►

USA TODAY May 31, 2002

Advanced Resources International



What to Believe?

Expectations for the “supply crunch” by market “bears” are based on three arguments:

- **#1 No Supply Response to Recent Drilling**
- **#2 Accelerated Depletion of Reserves**
- **#3 All the Big Fields Have Been Found**



Myth #1. No Supply Response

"I can't get no satisfaction."

Rolling Stones

The “bears” claim that there has been “no supply response” to the recent “drilling boom” - - new gas wells have doubled but production has remained flat.

	Natural Gas Production (Bcf)			
	1999	2000	2001	2002
First Quarter	4,712			4,849
Second Quarter				
Third Quarter				
Fourth Quarter		4,759	4,890	
Gas Completions (Wells)	10,900	16,500	22,100	

Source: Modified from Simmons & Co.



Reality #1: *Favorable Proved Reserve Response*

There has been a strong, favorable “reserve additions” and “reserves per well” response to recent gas drilling, particularly after adjusting for massive shallow PRB CBM drilling.

	Gas Wells/Year	Reserve Addition/Year (Bcf)	Reserves Per Well (Bcf)
A. Historical Drilling			
1991-93	9,250	15,160	1.6
1994-96	9,060	19,740	2.2
1997-99*	11,170	19,260	1.7
B. “Drilling Boom”			
2000-01	19,270	27,530	1.4
2000-01 (w/o PRB CBM*)	14,890	26,480	1.8

*Powder River Basin Coalbed Methane

Source: Advanced Resources International (2002)



Myth #2: Accelerated Depletion

“You’re just in time to be too late.”

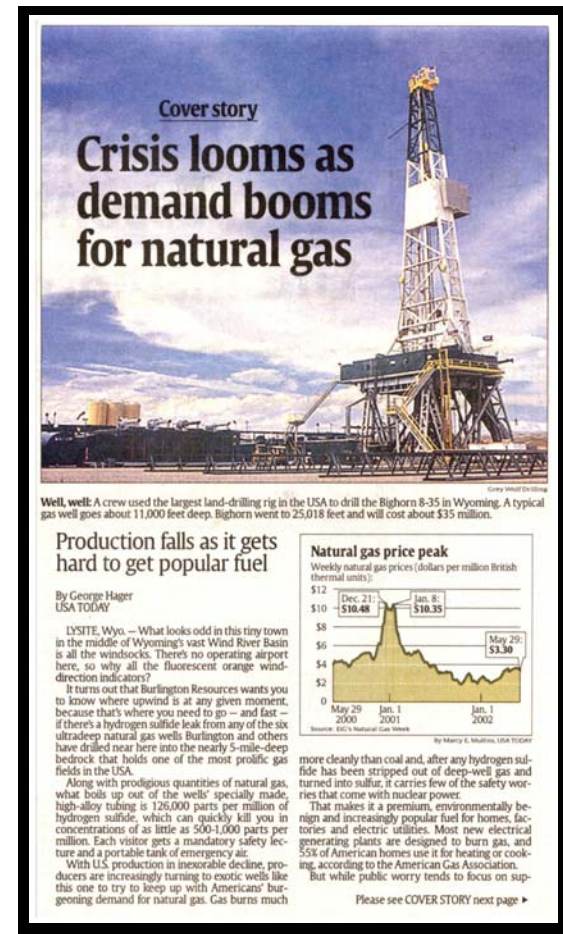
Hank Williams

“Analysts are alarmed by the fact that gas wells peter out much more quickly now than they used to, thanks to technology that lets producers drain reservoirs more quickly and the fact that reservoirs tend to be smaller.”

USA Today

“Natural gas decline rates have exploded over the past decade.”

Raymond James & Assoc.



USA TODAY May 31, 2002



Reality #2: *Accelerated Production is Economically Favorable*

“Accelerated depletion” implies two similar sounding but radically different phenomena:

- **Accelerated production** of discovered natural gas fields is favorable. It enables the industry to be more efficient (by maintaining a smaller “warehouse” of reserves) and it helps smaller fields to become economic.
- **Accelerated depletion of the resource** is a much more serious issue. Its severity may be assessed using three benchmarks:
 - *Future (remaining) resources become smaller with time*
 - *Annual reserve additions are progressively less*
 - *Returns to drilling are diminishing*



Reality #2: *Future (Remaining) Resources Are Larger Than 20 Years Ago*

Official national estimates of remaining resources (and the size of the U.S. natural gas resource base) have expanded significantly in recent years:

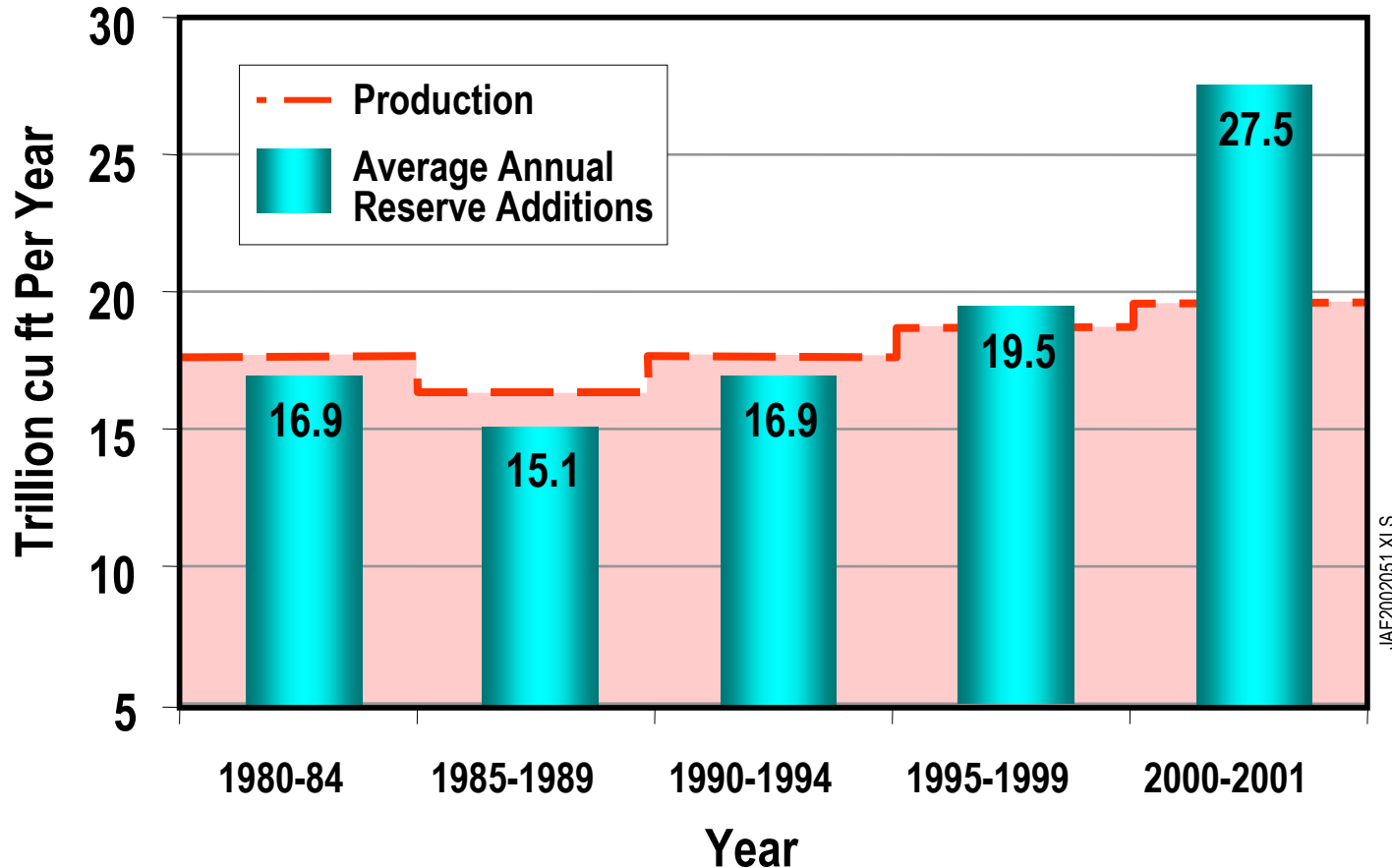
	<u>1981</u> (Tcf)	<u>Latest*</u> (Tcf)
Future Resources	594	1,375
Proved Reserves	178	167
Past Production	<u>596</u>	<u>950</u>
TOTAL	1,368	2,492 **

**Prepared by USGS (1995) for onshore resources and MMS (2000) for offshore resources.*

***The natural gas resource base has grown by 1,024 Tcf, or about 50 Tcf per year since 1981.*



Reality #2: Reserve Additions Are Up and Have Significantly Exceeded Production



Source: DOE/EIA Reserves Report (1980-2001), Advanced Resources Int'l (2002)



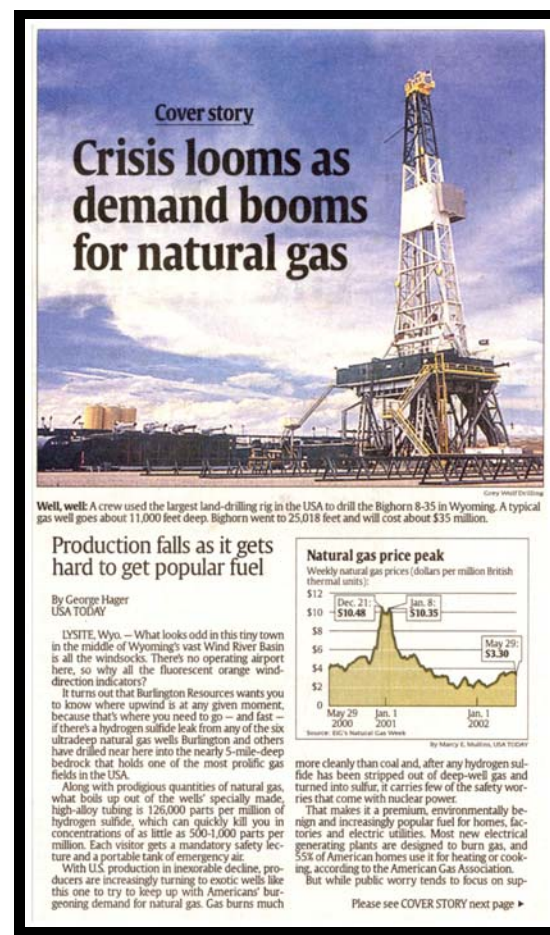
Myth #3. No More Big Fields, No More Supply

“All the good girls have been taken.”

Chris Isaak

“We’ve been poking holes in the lower 48 since the 1920’s . . . all the relatively easy gas producing areas have long been picked over. Most of what’s left are tough and expensive fields like . . . deep gas.”

USA Today



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Reality #3: *The Nature of the Remaining Resource Base is Different Not Smaller*

“Looking for love in all the wrong places.”

Mickey Gilley

Basin-center/tight gas, deep gas, and coalbed methane (plus the deep water) have accounted for the majority of recent Tcf size natural gas discoveries.

Major Discoveries and Rediscoveries	Type of Resource	Initial Reserves* (Tcf)	Play Potential (Tcf)
Jonah/Pinedale (GGRB)	Basin Center	3	16
Wyodak Fairway (PRB)	CBM	3	10+
Cave Gulch/Madden (WRB)	Tight Gas	2	9
Madden Deep (WRB)	Deep Gas	2	5
Drunkard's Wash (UB)	CBM	2	4
Newark East (FWB)	Gas Shales	1	10
Rulison (PB)	Basin Center	1	10
Raton (RB)	CBM	1	5

Source: Advanced Resources International, Inc. compilation from internal basin studies and industry reports.

*A Tcf size discovery (175 MMBOE) is similar to the largest fields discovered in the Gulf of Mexico (shelf) during the 1950s and 1960s.



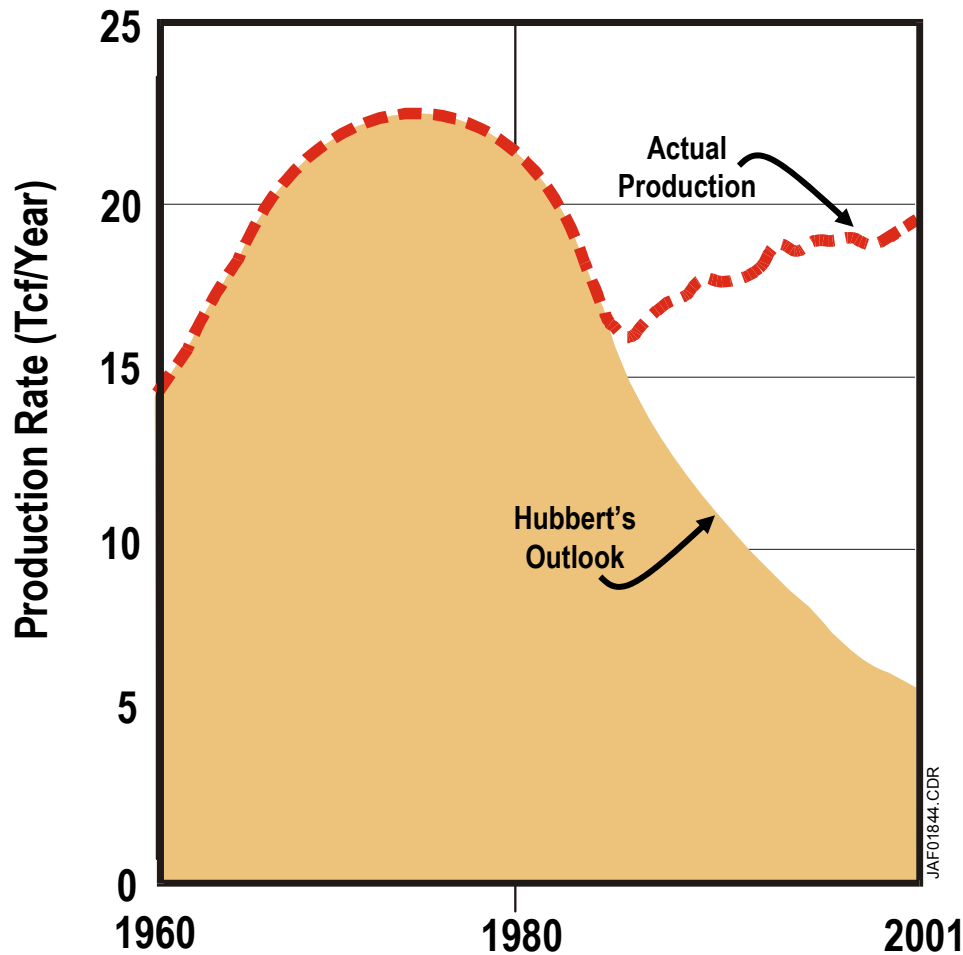
Longer Term Outlook for Natural Gas Supply

Longer term, the outlook for natural gas will be determined by the nature of the resource base and the technology required to convert this resource base into reserves.

- One view, presented compellingly by M. King Hubbert, is that the recoverable resource base is limited and remains fixed.**
- A second view is that technology progress enables the recoverable resource base to continue to grow (be dynamic).**



Is the Resource Base Fixed or Dynamic?



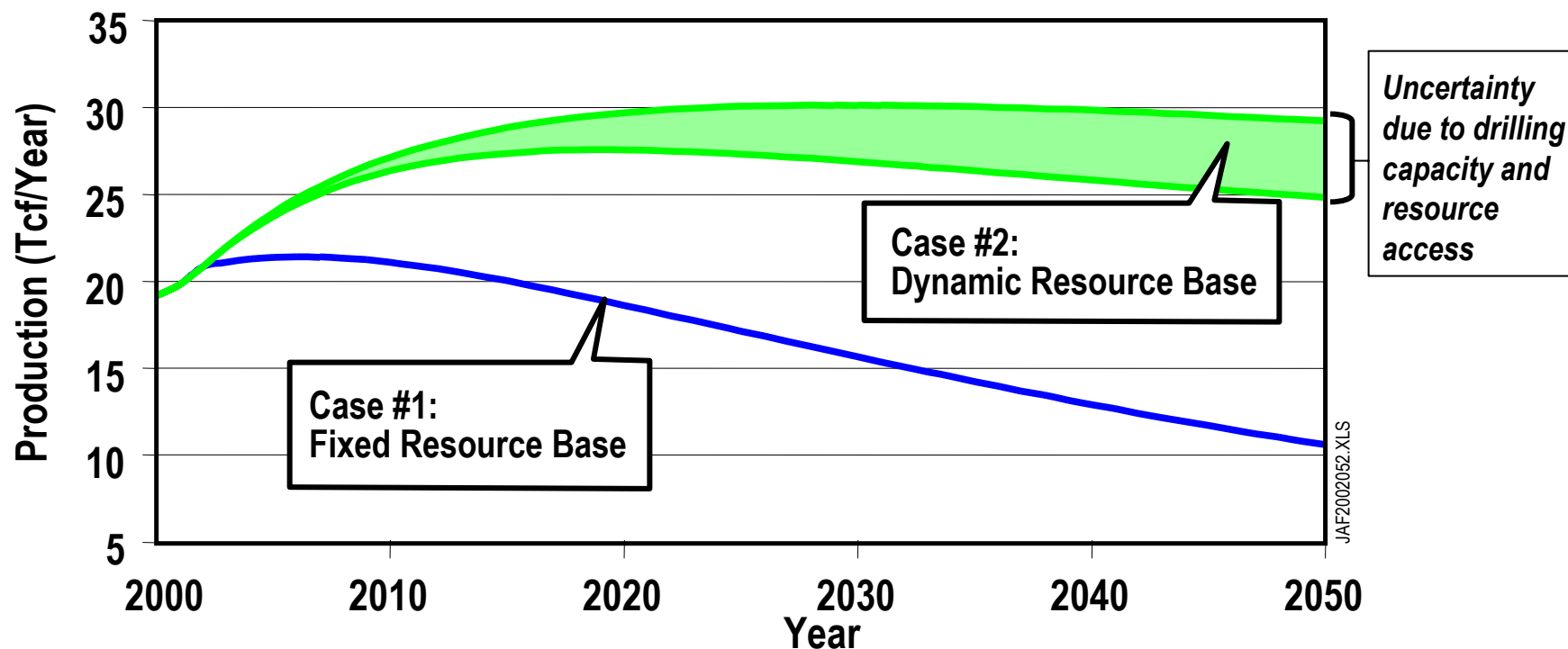
(Modified from Hubbert, 1974)

Hubbert's outlook for natural gas has proven to be pessimistic:

- Improved resource knowledge added the offshore, unconventional gas and deep gas to the recoverable resource base.
- Technology progress (e.g., 3D seismic, advanced well stimulation and reservoir characterization) enabled these new resources to become economic.



Long Term Outlook for U.S. Natural Gas Production



	Resources	Resource Conversion	R/P Ratio
Case 1: Fixed Resource Base	1,200 Tcf (PGC)	2%/Yr	8.8
Case 2: Dynamic Resource Base	1,550 Tcf (USGS/MMS) +20 Tcf/Yr	2% to 2.75%/Yr	8.8

Source: Advanced Resources Int'l (2002)



Closing Observations

1. Is the natural gas resource base sufficient to support growth in production?

Yes - - if technology progress continues to outpace resource depletion.

2. What level of investment in technology progress (and R&D) will be required, particularly to convert the increasingly complex resource base into economic supply?

Several fold larger than is being invested today.

3. Will natural gas prices remain affordable once demand increases?

Accelerated progress in technology, development of new resources and access/transportation for Rocky Mountain basins will help keep gas prices affordable.



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